Development of a Biomarker System for Detecting Exposure to Waterborne Viral Pathogens

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EPA has published a drinking water Contaminant Candidate List (CCL) that includes waterborne pathogens and chemicals that may be considered for regulation at a future date. For each contaminant on the CCL, the Agency will need sufficient data to conduct analyses on the extent of exposure and the risk posed to populations via drinking water. Previous studies indicated that exposure to some microbes, including the CCL pathogen coxsackievirus B3 and B4, may be associated with serious long-term health consequences (sequela), such as myocarditis and type-1 diabetes. However, little is known about waterborne-associated infections by these microbes and their linkage to chronic diseases. In addition, surveillance reports by EPA and the Centers for Disease Control and Prevention (CDC) suggest that etiological agents cannot be identified in a large percentage of outbreaks. It is suspected that many of the unidentified pathogens may be viruses. Our inability to culture many viral pathogens has made their identification very difficult. Therefore, it is important to develop biomarkers of viral exposure to be able to investigate the relationship between the environmental exposure and human diseases.

In the present study, interferon gamma (IFN-γ) was selected as a biomarker in an animal model for a viral exposure study. To determine whether IFN-γ can be used as a biomarker for the viral infection, twelve week-old BALB/c mice were intraperitoneally injected with coxsackievirus B3 or B4 diluted in phosphate-buffered saline (PBS). Control group mice were injected with PBS only. Four months after viral infection, mouse thymus and spleen were collected. T lymphocytes were isolated from the organs and assayed for the release of IFN-γ after *ex vivo* stimulation (incubation) with viral antigens, phytohaemagglutinin (PHA) and PBS, respectively. The level of IFN-γ released by T lymphocytes was examined by antibody-capture, chemiluminescent, enzyme linked immunosorbent assay (ELISA). Our results demonstrated that IFN-γ produced by memory T cells is virus specific and can be used as a biomarker in viral exposure studies. The results of this study indicate that the measurement of IFN-γ may provide an ideal biomarker for human exposure studies related to waterborne microbial pathogens. Furthermore, this new approach may offer a better and more accurate method for risk/exposure assessment to microbial pathogens.

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